TMDL DEVELOPMENT

KITS CREEK

FINAL PUBLIC MEETING

OCTOBER 6, 2016
6 – 8 PM

Paula Main

Ginny Snead, Erin Hagan,
Sue Lindstrom

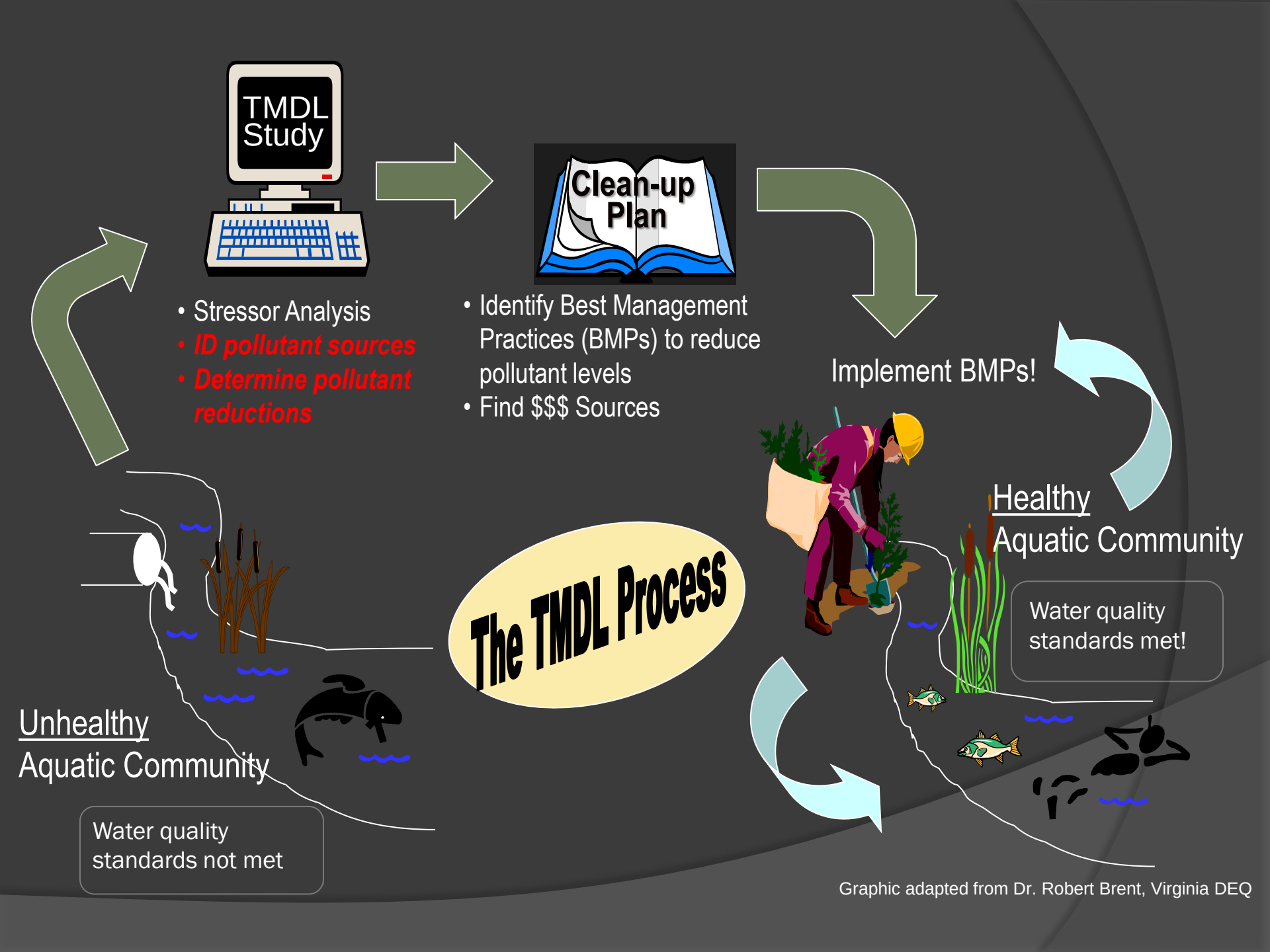
DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Louis Berger

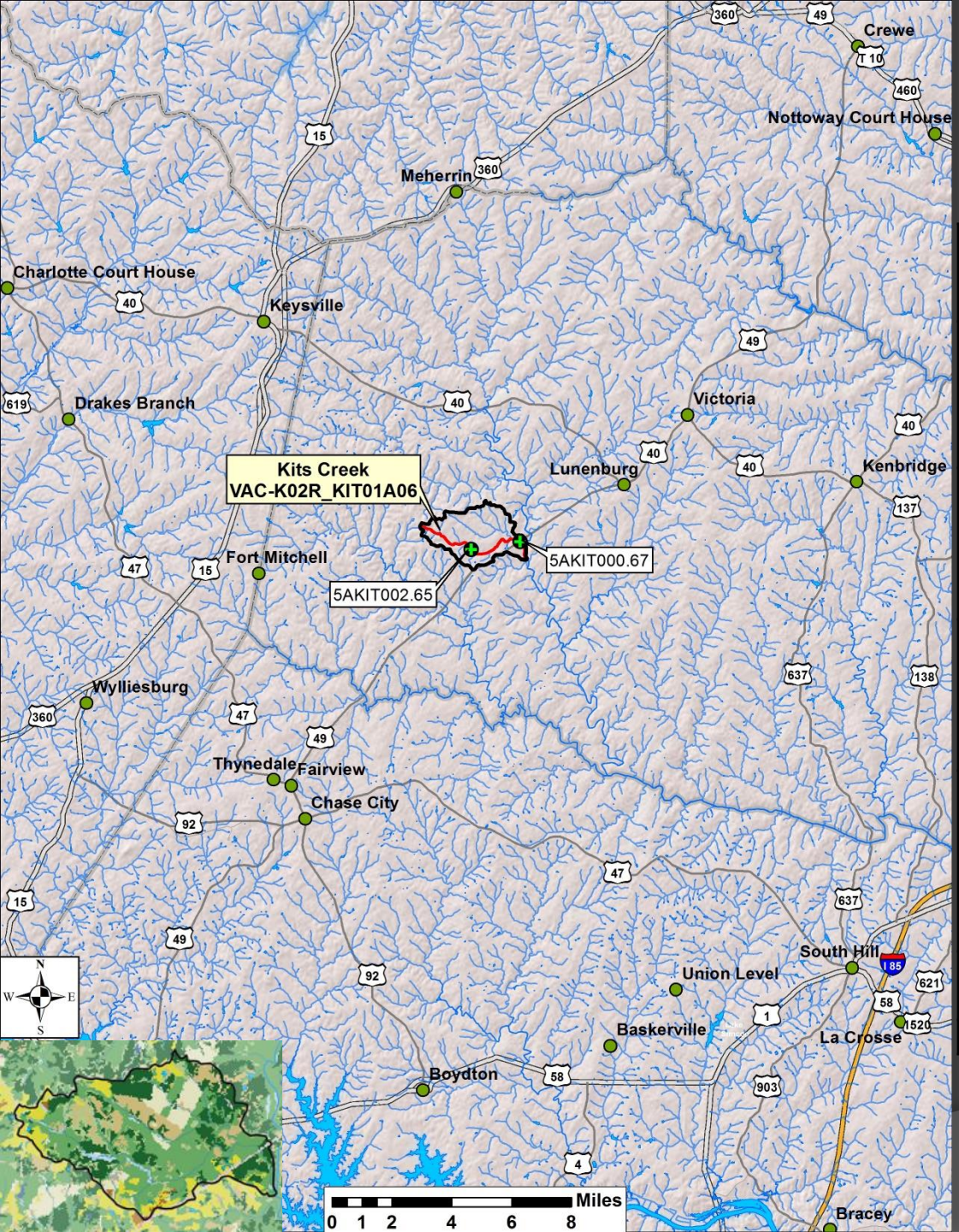
Kits Creek Benthic TMDL Final Public Meeting

AGENDA

1. Welcome
2. Review of impairment , stressors, and reference watershed
3. Modeling Approach and Endpoint Identification
4. TMDL Allocations
5. Next Steps

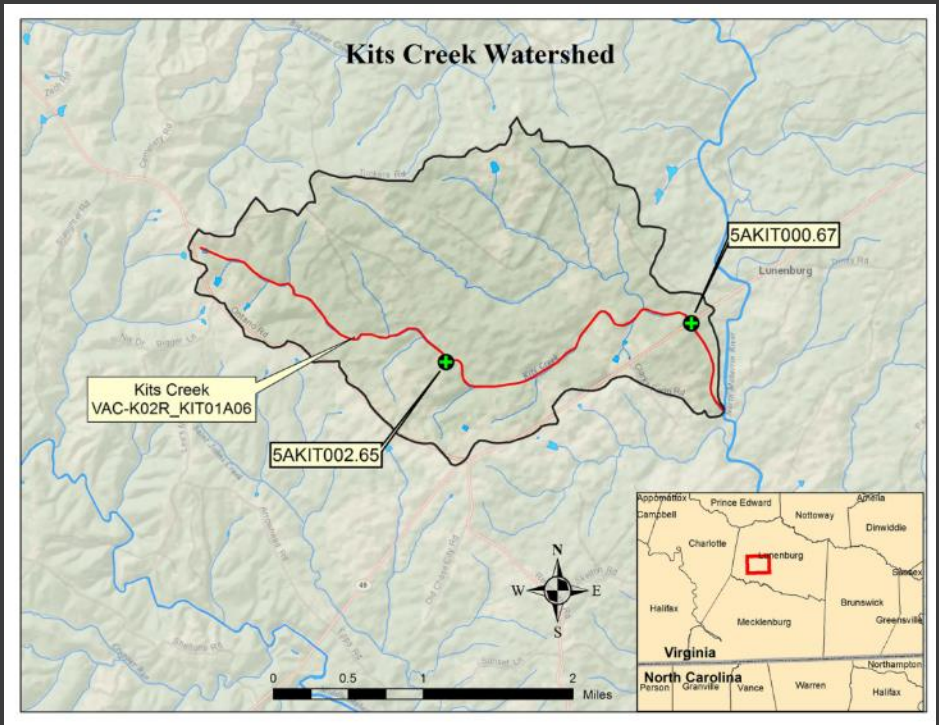

TMDL Study
Clean-up Plan
• Stressor Analysis
• ID pollutant sources
• Determine pollutant reductions
• Identify Best Management Practices (BMPs) to reduce pollutant levels
• Find $$$ Sources
Implement BMPs!
Healthy Aquatic Community
Water quality standards met!
The TMDL Process
Unhealthy Aquatic Community
Water quality standards not met
Graphic adapted from Dr. Robert Brent, Virginia DEQ

Kits Creek Watershed



General Land Use Category	NLCD 2011 Land Use Category	Acres	% of Watershed	Total Acres	Total %
Developed	Developed Low Intensity	0.5	0.02%	65.9	2%
	Developed Open Space	65.4	2.2%		
Agricultural	Cultivated Crops	22.5	0.7%	519.0	17%
	Pasture/Hay	291.3	9.7%		
	Grassland/ Herbaceous	205.3	6.8%		
Forest	Deciduous Forest	1101.1	36.6%	2,032.9	68%
	Evergreen Forest	680.6	22.6%		
	Mixed Forest	251.2	8.4%		
Water and Wetlands	Open Water	1.1	0.04%	52.5	2%
	Emergent Herbaceous Wetlands	1.3	0.04%		
	Woody Wetlands	50.0	1.7%		
Other	Scrub/Shrub	330.1	11.0%	338.3	11%
	Barren Land	8.2	0.3%		
Total		**3009**	**100%**	**3009**	**100%**

Kits Creek Impairment



- First listed in 2008 for benthic impairment using station 5AKIT002.65
- Biological assessment surveys showed unhealthy macroinvertebrate communities
- Kits Creek does not support the aquatic life use

Cause Group Code	Segment Name	Assessment Unit	Segment Length (miles)	Impairment	Designated Use
K02R-03-BEN	Kits Creek	VAC-K02R_KIT01A06	4.82	Benthic-Macroinvertebrate	Aquatic Life

Most Probable Stressors

- Phosphorus
  - Elevated total phosphorus levels and excessive periphyton growth
- Sedimentation
  - Habitat data indicating elevated sedimentation and observation of suspended solids

Reference Watershed Approach

- TMDL endpoints are based on conditions in a similar, but non-impaired reference watershed.
- Reduction of the sediment and phosphorus loads in the impaired watershed to levels comparable to the reference watershed is assumed to be sufficient for recovery of the benthic community in the impaired watershed.
- Loads for the Suanee Creek reference watershed were adjusted to reflect the size of the impaired Kits Creek watershed to develop the endpoint.

Reference Watershed Suanee Creek

Benthic Monitoring Data: Average VSCI scores above 60

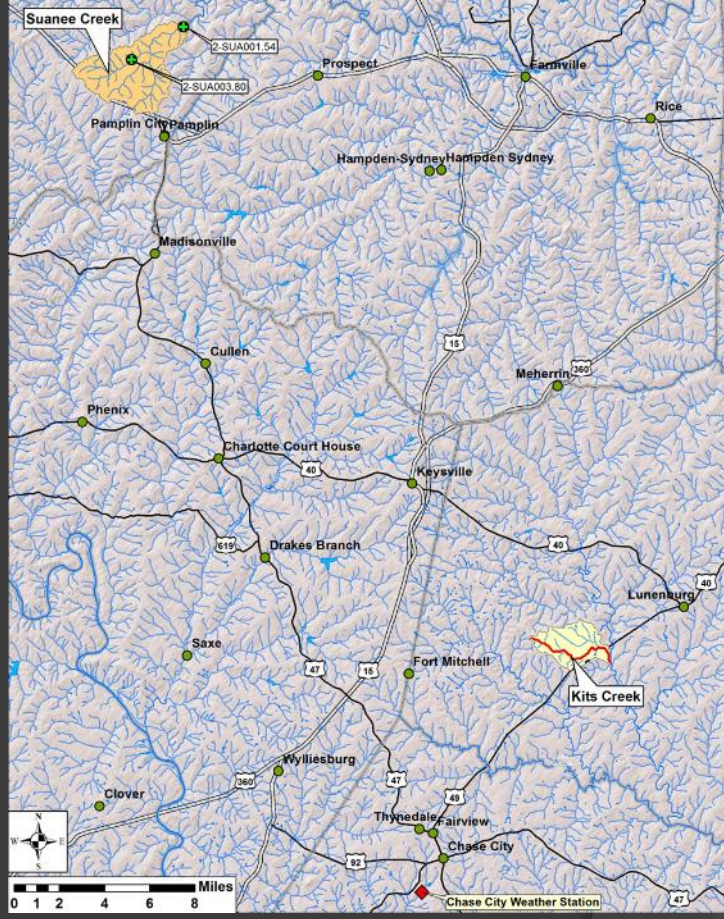
Ecoregion: Piedmont

Land Use: Forest and agriculture

Soil: Moderate to severe erosion potential

Watershed Size: Kits Creek 3,009 acres
Suanee Creek 7,021 acres

Location: 28 miles apart



Land Use		
	% of Total Watershed	
	Kits Creek	Suanee Creek
Developed	2	4
Agricultural	17	17
Forest	68	65
Water/ Wetlands	2	3
Other	11	11

Potential Erosion Hazard		
	% of Total Watershed	
	Kits Creek	Suanee Creek
Slight	6.1	15.0
Moderate	47.2	45.9
Severe	46.5	38.3
Not rated (water)	0.2	0.4

MODELING APPROACH AND ENDPOINT IDENTIFICATION

Sediment and Phosphorus Sources

- **Point sources**
- **Nonpoint sources** - runoff from various land uses
- **Instream erosion**
  - Sediment via stream bed and bank erosion and eventual downstream deposition
  - Phosphorus via adsorption to sediment

These sources adversely impact the benthic macroinvertebrate community through loss of habitat and degradation of water quality.

Technical Modeling Approach

1. Land Based Load – GWLF Model
   - USGS Flow Station on the North Meherrin River was used to calibrate the hydrology parameters used in GWLF.
   - Sediment and phosphorus delivery ratios are applied to the to determine the sediment and phosphorus loadings to the stream.
2. Instream Erosion – Evans et al. (2003) Method

Loads calculated for Suanee Creek (reference) are adjusted for the smaller size of the Kits Creek (impaired) watershed.

Application of Technical Approach

1. Calculate the point source, nonpoint source land based (using GWLF), and instream loads
2. Add all loads for a total
3. Load Calculation Process:
   a. Determine Suanee Creek watershed load
   b. Determine Kits Creek loading (existing load)
   c. Adjust the Suanee Creek load to account for size of impaired Kits Creek watershed (endpoint)

Estimating Loads

- Land-based loads
  - GWLF model simulations (2007 to 2015) for Kits and Suanee Creek watersheds to estimate existing land-based loads from the hydrologically calibrated model
  - Land based loads are adjusted for Kits Creek area
- Instream erosion loads
  - Estimates existing loads for impaired and reference watersheds
  - Instream erosion loads also adjusted for area

Average Annual Sediment Loads (tons/year)

Source	Impaired Watershed	Reference Watershed	Adjusted Reference Watershed
Water	0.0	0.0	0.0
Barren Land	0.7	0.2	0.1
Deciduous Forest	33.8	87.9	43.9
Evergreen Forest	20.7	26.5	13.2
Mixed Forest	7.4	4.5	2.3
Shrub/Scrub	10.0	20.0	10.0
Pasture/Hay/Grassland	65.8	131.7	65.8
Cultivated Crops	25.9	10.3	5.2
Woody Wetlands	0.0	0.0	0.0
Developed, Open Space	0.1	0.3	0.1
Developed, Low Intensity	0.0	2.1	0.9
Instream Erosion	3.0	9.1	6.4
Point Sources	0.0	0.0	0.0
Total	**167.3**	**292.6**	**147.9**

Average Annual Phosphorus Loads (pounds/year)

Source	Impaired Watershed	Reference Watershed	Area Adjusted Reference Watershed
Barren Land	7.7	0.7	5.6
Deciduous Forest	61.7	106.5	61.7
Evergreen Forest	32.9	30.9	32.9
Mixed Forest	13.5	5.5	13.5
Shrub/Scrub	15.9	23.2	15.9
Pasture/Hay/Grassland	343.3	246.5	251.3
Cultivated Crops	50.1	12.8	36.6
Woody Wetlands	1.1	0.9	1.1
Developed, Open Space	231.5	127.9	169.5
Developed, Low Intensity	0.4	14.6	0.3
Groundwater	54.7	126.1	54.7
Point Source	0.0	0.0	0.0
Total	**812.8**	**695.3**	**656.2**

TMDL Endpoints

- **Sediment –** Loadings from Suanee Creek watershed adjusted for the smaller acreage of Kits Creek watershed (147.9 tons/year)

- **Phosphorus** – Average of TP value (0.025 mg/L) from Suanee Creek monitoring station
  - TP loadings in lbs/year based on this

TMDL Expression

$$TMDL = \sum LA + \sum WLA + MOS$$

TMDL = Total Maximum Daily Load (Based on the area-adjusted reference watershed sediment load)

WLA = Wasteload Allocation

LA = Load Allocation

MOS = Margin of Safety

Sediment Allocations

Source	Land Use Type	Existing (tons/year)	Allocated (tons/year)	Percent Reduction
Land Sources	Barren Land	0.68	0.44	35.2%
	Deciduous Forest	33.79	33.79	0.0%
	Evergreen Forest	20.72	20.72	0.0%
	Mixed Forest	7.35	7.35	0.0%
	Shrub/Scrub	10.00	6.47	35.2%
	Pasture/Hay/Grassland	65.82	42.62	35.2%
	Cultivated Crops	25.88	16.76	35.2%
	Developed, Open Space	0.10	0.06	35.2%
	Developed, Low Intensity	0.01	0.01	35.2%
Instream Erosion	-	3.00	1.94	35.2%
Point Sources	Point Source Sediment	0.00	0.00	0.0%
	Future Growth (2% of the TMDL)	-	2.96	-
Margin of Safety	10% of the TMDL	-	14.79	-
	Total	**167.34**	**147.91**	**11.6%**

TMDL (tons/year)

Wasteload Allocation[1]	Load Allocation	Margin of Safety (10%)	TMDL
2.96	**130.2**	**14.8**	**147.9**

[1]Wasteload allocation includes 2% of the TMDL for Future Growth

Phosphorus Allocations

Source	Land Use Type	Existing (lbs/year)	Allocated (lbs/year)	Percent Reduction
Land Sources	Barren Land	7.7	5.6	26.81%
	Deciduous Forest	61.7	61.7	0.0%
	Evergreen Forest	32.9	32.9	0.0%
	Mixed Forest	13.5	13.5	0.0%
	Shrub/Scrub	15.9	15.9	0.0%
	Pasture/Hay/Grassland	343.3	251.3	26.81%
	Cultivated Crops	50.1	36.6	26.81%
	Developed, Open Space	231.5	169.5	26.81%
	Developed, Low Intensity	0.4	0.3	26.81%
Groundwater	-	54.7	54.7	0.0%
Point Sources	Future Growth (2% of the Total Allocated Load)	-	13.1	-
	Total	**812.8**	**656.2**	**19.27%**

TMDL (pounds/year)

Wasteload Allocation[1]	Load Allocation	Margin of Safety	TMDL
13.1	**643.1**	**IMPLICIT**	**656.2**

[1]Wasteload allocation includes 2% of the TMDL for Future Growth

Next Steps

- 30 Day Comment Period for Draft TMDL (October 6 – November 6)
- Prepare Final Benthic TMDL Report
- Submit Final Kits Creek Benthic TMDL Report to VADEQ and to EPA

Contacts

Paula B. Main, VA DEQ
7705 Timberlake Road
Lynchburg, VA 24502
Phone: (434) 582-6216
Email: paula.main@deq.virginia.gov

Reports/presentations available at:
http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/TMDL/TMDLDevelopment.aspx

Louis Berger
Ginny Snead
Phone: (804) 658-6386
Email: gsnead@louisberger.com

Erin Hagan
Email: ehagan@louisberger.com